The Undergraduate Medical Curriculum (1969 Model): McMaster University

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"Let the main objective be as follows: to seek and find a method of instruction by which teachers may teach less but learners may learn more." The Great Didactic of Comenius (1592-1670).†

CURRENT dissatisfaction with medical education imposes on a new medical school a responsibility of experimenting with novel approaches. How planners of the undergraduate curriculum in Canada's fourteenth medical school have responded to the urge to innovate, is the subject of this paper. The reader will enter into the spirit of our planning if he accepts modification and change as the only constants. When the first medical students are admitted in September 1969, learning will begin in the context to be described. Time will tell which features are retained, which discarded and which prove of sufficient interest to be tried elsewhere.

The components of this three-year course can be seen in Fig. 1: Phases I, II, III, electives, revision periods and the clinical clerkship in vertical segments, and a horizontal block. Compared to more traditional four-year courses with approximately eight academic months per year, the new one permits a one-month rather than a four-month summer break. The number of weeks of prescribed academic activity totals 112. In addition there are 12 weeks of elective time.

OBJECTIVES

There are two broad objectives:

1. To help students become effective solvers of biomedical problems, by enabling them to understand the principles essential to the solution of such problems, and by teaching them how to seek out and use the information required for their solution.

2. To foster attitudes leading to behaviour as responsible physicians and scientists in their relation to patients, colleagues and society. Such behaviour is marked by compassionate concern for patients coupled with action to promote the public good when the physician is faced with ethical decisions.

To attain these objectives, students will be introduced to patients and their problems during the first weeks of the course. It is hoped that students, stimulated by this experience, will see the relevance of what they are learning to their future responsibilities, will maintain a high degree of motivation and will begin to understand the importance of responsible professional attitudes. Learning will centre on a series of major biomedical problems and questions; for their solution students will have to understand essential principles and collect relevant data. The faculty will function as tutors or guides to learning, helping students as they wrestle with the problems. To fulfil this function the faculty tutors will employ small group discussions and laboratory sessions. They will also guide the study of learning resources—printed, graphic and auditory.

ADMISSION REQUIREMENTS

The minimal requirements will be three years of university work, including courses in behavioural science, biochemistry and cell biology. Students who are completing a degree program (preferably an honours course) at a recognized university will be eligible. The most direct and probably the most popular preparation for the course will be to enter Natural Sciences I at McMaster University and then take two further years in Honours Biology or Honours Biochemistry in the Division of Science. During his third year the student can apply for admission to the Faculty of Medicine and, if accepted, will receive his B.Sc.(Med.) after the first year in Medicine: if he does not gain entry into the Faculty of Medicine, he can finish his program in biology or biochemistry. Applicants accepted by the Faculty of Medicine who lack behavioural sciences, biochemistry or cell biology will be required to take special courses in these subjects before beginning the medical course.

We plan to take students from a wide variety of educational backgrounds, including psychology, sociology, anthropology, the humanities,

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†Comenius,[1] a famous writer on education, was born in Moravia, studied at Heidelberg, and visited or lived in England, Holland, Poland and Sweden. His original method of teaching Latin and Greek was to set out, in parallel columns, useful sentences in the vernacular and the language to be taught. In some of his books pictures are added; one is the first children's picture book. Disgusted by the pedantic teaching of his day, he insisted that the teaching of words and things must go together. Languages should be taught like the mother tongue, by topical conversation, using pictures and objects. In his course he included singing, economy, politics, world history, geography, science, the arts and handicrafts.

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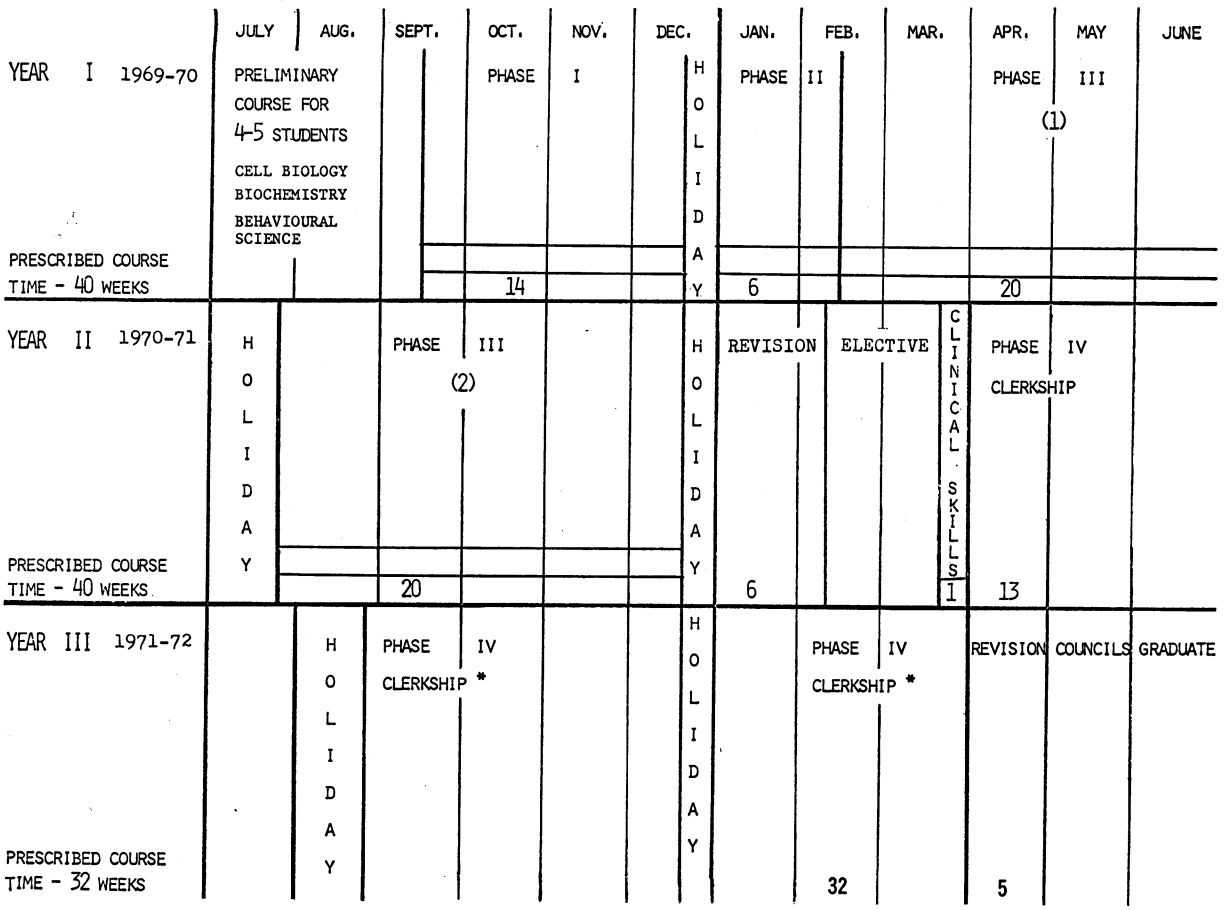

Fig. 1.—Outline of the curriculum.
*Includes six weeks of elective time.

engineering, physics and mathematics. Some will take the preliminary course described in the next section. The traditional premedical course has recently been discontinued at this university. Such a program forces a career decision on the student at an early stage and tends to give all students a similar background. Furthermore, a degree earned at the end of a designated premedical course may not be particularly helpful to a student who fails to gain entry to a medical school.

PRELIMINARY SUMMER COURSE

As an experiment, a small number of students who lack the admission requirements will be admitted into the medical course provided they take an intensive summer tutorial course in behavioural science, biochemistry and cell biology. There are two reasons for this approach: (1) to permit such students to obtain a medical education without adding a year or more on to their university careers in order to qualify for admission; (2) to find out whether able students who have demonstrated their ability to learn in a variety of demanding university courses can, in a short time, become sufficiently familiar with the concepts and vocabulary of modern human biology to learn medicine.

Such students will be assured a place in the first medical year before they take the summer course. They will not be required to pass an examination at the end of the summer, although tests may be used to allow students and faculty members to determine how well they are grasping the topics studied.

Phase I—Normal Structure and Function (14 weeks)

This phase deals with selected aspects of human biology, including anatomy, histology, embryology, genetics, physiology, physical examination, normal human behaviour, professional ethics and attitudes, and biomedical statistics. The use of the library and other learning resources will be emphasized.

The approach will be predominantly regional. For example, as the student learns about the structure and function of the eye he will also

learn how the doctor examines the eye to test the integrity of the organ and its associated controlling structures and mechanisms. At this time, patients with disorders of the eye can be seen, not so the student may learn the details of pathological states, but to demonstrate that disease is a departure from the healthy state.

Phase II—Abnormal Biological Mechanisms (6 weeks)

The major topics will include: the general features of responses of cells to injury, infection, and drug actions; inflammation, immunopathology, genetics and disease, and abnormal behaviour.

Phase III—Abnormal Structure and Function (40 weeks)

This portion of the curriculum is organized by organ systems and includes relevant aspects of abnormal behaviour, ethics, biomedical statistics and rehabilitation medicine. The systems are hemopoietic, cardiovascular, respiratory, gastrointestinal, urinary and electrolyte, nervous, locomotor and endocrine/reproductive. Each system will be studied by an integration of relevant anatomy, biochemistry, physiology, microbiology, pathology, pharmacology, psychology and epidemiology.

The first class will consist of 20 students. (When the Health Sciences Building is constructed and in operation, the size of class will be 64.) Each block of five weeks will have as the major faculty resource a different group of faculty tutors who will be responsible for planning the five-week period. Each faculty member will have four students depending on him for guidance. The faculty will be enlisted from a variety of backgrounds yet share a common interest in the system. For example, the group presently planning the cardiovascular section consists of a pathologist whose major interest is atherosclerosis and coronary artery disease, a radiologist with experience in angiography, an epidemiologist who is associated with the well-known Framingham study of risk factors in coronary artery disease, a cardiovascular surgeon whose research is concerned with thrombosis, and a clinical cardiologist.

Horizontal Program—equivalent of 1 hour per day in Phases I to III

This is a continuum devoted to consideration of problems relating to professional attitudes and ethics, abnormal behaviour, rehabilitation medicine, biomedical statistics and epidemiology.

Electives—two six-week periods after Phase III

The purpose of elective experience is to encourage scholarly endeavour, in depth, in a biomedical topic. Several categories of electives will be available including: (1) experience in a laboratory with an individual or a group of investigators; (2) experience with an individual or a group in a clinical teaching unit; (3) association with a group whose activities involve several teaching units and laboratories, for example, clinical epidemiology and data processing; (4) suitable electives offered by other medical schools, health institutions or individuals which meet with the approval of our faculty; and (5) course work, e.g. in graduate school.

Faculty members will arrange electives. In addition, students will be encouraged to approach faculty members about projects which are not included in the elective list. Therefore, there will be two varieties of electives: those planned and offered by the faculty, and independent projects developed by students and acceptable to the faculty.

Clinical Skills (1 week)

The skills of history-taking, examination and the planning of further investigation and treatment will be organized to link and co-ordinate what has already been learned about the pathogenesis of symptoms and signs with the assumption of responsibility for patients which begins in the clerkship.

Phase IV—Clerkship (40 weeks)

The clerkship consists of four interchangeable blocks of: medicine; family practice (including preventive and rehabilitative aspects); surgery and psychiatry; pediatrics, and obstetrics and gynecology.

DISCUSSION

The method of planning a new curriculum or revising an established one deserves at least as much attention as the bits and pieces included. If planning is done by individuals rather than by groups, by departments rather than by faculty interested in and working on problems of mutual interest, then an autocratic, discipline-oriented, fragmented curriculum is inevitable. The potentates will be department chairmen defending the boundaries of their discipline and vying for their share of recognition which is measured in hours of teaching time. To prevent the development of this situation, planning not only of each portion but also of the entire cur-

riculum must be undertaken by groups, not by individuals, and by mixes of faculty members who are approaching similar problems from various angles with a variety of methods, techniques and background experiences. The age, rank and departmental affiliation of planners become factors of negligible significance in the selection of faculty. Qualities of imagination, flexibility, adaptability and leadership in a democratic system, coupled with high standards of scholarship, become of paramount importance. The faculty planner and participant in undergraduate education should identify himself with the medical course in such a way that he thinks of "our" students, meaning students of his medical school, rather than "my" students, meaning students taking "my" biochemistry course or "my" surgical clerkship. Needs of students for a medical education transcend the aspirations of individual faculty members to replicate themselves by attempting to persuade students that their field is exalted above all others.

A vital ingredient in the organization and planning is an education office with a competent staff dedicated to effective planning and to implementing decisions of the faculty. We have appointed an Education Co-ordinator who has a background of political science and government service in education. He sits with planning groups and is a member of the central Education Committee. He collates efforts, provides information, and is the project manager of curriculum building. In his office curricula of other medical schools, articles, books, catalogues of learning resources and all the reports of planning groups are centralized.

In this century we are in a much better position to carry out the "Great Didactic of Comenius" than was this great man in his own time, the seventeenth century. The ways in which "learners may learn more" have expanded from the spoken and written word to a variety of audio-visual techniques and educational approaches which include programmed learning and programmed patients. To take advantage of this we have established a Learning Resources Unit for production, acquisition, cataloguing, and distribution of plastic-imbedded specimens, slides, movies and video-tapes. Carrels are being designed to permit students to study sets of Kodachrome slides in carousels with synchronized audio-tapes (an effective substitute for lectures) and movies or video-tapes.

The tutor or guide to learning is a role which the faculty have traditionally assumed in graduate schools, and to some extent in the small group format of clinical education. If undergraduate students are to develop habits which will lay the basis for individualized lifelong learning, then they should have time and opportunity to learn at the speed and in the way best suited to them. The faculty tutor can introduce a topic to his small group, can help students decide how they will learn about the topic, can indicate the learning resources available, and can himself be a learning resource for his students. Because a close relationship with a small group of students is mandatory for this tutorial role, faculty offices are being designed to accommodate the faculty member and four students with a combination desk and worktable arrangement.

The faculty tutor will share a common interest with his fellow tutors working in a particular segment of the course, e.g. the block in Phase III devoted to the nervous system. Because of the varied backgrounds and points of view of faculty members there is an excellent opportunity for a profitable interchange of ideas, approaches to problems, and information which will foster the continuing education of each member of the faculty. Since all planning is done in groups, each faculty member's ideas are moulded by his colleagues. The selection of topics, principles and data requires that each faculty member think critically about essential aspects and compare his views with those of his colleagues. In so doing he will be learning more about his own field of interest as seen through the eyes of his colleagues. After the students begin their studies, questions will arise which the faculty tutor will be unable to answer. These questions can be put to colleagues in discussion groups involving students and several faculty members. Furthermore, as students in such discussion groups present what they have learned, the faculty will also have the opportunity to learn from the students and from each other.

Evaluation of students will be, to a considerable extent, dependent on frequent evaluation by faculty tutors. A simple grading system of above average, average and unsatisfactory should help to minimize competitive rivalry and still permit the exceptional student to be recognized when prizes are awarded to the "best" in a certain field. Tests and examinations can be used by faculty groups to determine the effectiveness of learning.

Medical students will have an important part in evaluating the course and assessing the efforts of faculty members. Student members of the Education Committee will provide impromptu feed-back as well as systematic appraisal of their undergraduate experience. Un-

doubtedly extensive revisions will be required once the course is in operation; students will be part of groups responsible for revising the curriculum. In the summer of 1968 students from the University of Toronto met with the Education Committee to discuss our curricular plans. The students provided insights and points of view which were most helpful.

There is a great deal of talk about "core curriculum" and "core content" amongst medical educators. The hope has been expressed that an agreed-on core of knowledge (and skills) could be identified, not only *in* each medical school, but also *for* all medical schools. Given such a core, the planning of mandatory course-work would be relatively simple because the aim would be to present the core. The remainder of the student's time would be spent in electives or in a number of paths tailored to a particular career choice, e.g. medical scientist, surgeon or family physician. It would appear better to stop emphasizing core *content* and to think in terms of core *questions* or *key problems*. For example, every medical student should have studied and tried to organize in his own mind illustrative data about important topics such as cardiogenic shock. He should be able to talk about or write about this topic, using examples and facts which help to explain cardiogenic shock. There need not be a fixed core content because there are a number of logical ways of approaching the topic and a very large number of facts. Each student or physician will select a somewhat individualized set of facts to remember to enable him to think about cardiogenic shock. Certain aspects of the topic will receive more attention from one person than from another. To one the myocardial fibril and its contractile protein may be the focal point, to another a pump model may serve best, another may emphasize the dynamics of fluid flow, while yet another may wish to think about cardiogenic shock chiefly in terms of baroreceptors, servo-mechanisms and reflex adjustments.

Whether we can provide the amount of small-group contact with faculty which is called for by the curriculum, when we enrol a class of 64 students, has been the subject of much discussion. We shall have two years in which to try this approach with the 20 students. If the recruitment of faculty proceeds as planned, we should have the required number to teach 64 students, provided that the course proceeds in the way we visualize it. A great advantage of enrolling a small class initially is the opportunity to see how things work out on a small scale before being committed to a large-scale operation.

The decision to have a three-year rather than the usual four-year undergraduate course was based on several considerations. There is a commendable trend to introduce students to cell biology, biochemistry and behavioural science in high school. By taking elective courses the university student in the humanities can usually meet the requirements for behavioural science and cell biology. (Difficulties arise concerning biochemistry where the student may find himself faced with a series of long courses in inorganic, organic and physical chemistry before he can learn biochemistry. Chiefly for this reason the preliminary summer course is being offered.) Therefore some introductory aspects of the subjects which have previously been included in medical-school curricula can be deleted. When this is done and when the usual prolonged summer break is eliminated, the number of weeks in a three-year course is only slightly less than in the usual four-year course. Government financial aid for students can be made available, in consideration of the student's requirement for support because he will not be able to earn money throughout the summer.

Some medical schools are providing opportunities for "streaming" before graduation, by which is meant concentrating on subjects and topics chosen with a view to a particular choice of career. For example, a student who planned to work in the field of behaviour as a psychiatrist would take a different path in his senior years than would a prospective surgeon, a medical scientist or a family physician. Rather than such a plan, we envisage the streaming taking place at the end of our three-year undergraduate course with paths available in medical science, family practice and consulting clinical specialties. Straight internships, rather than rotations, will be the choice of most graduates in clinical training. The length of time spent preparing oneself for private practice would extend from three years for family practice to longer periods for consulting specialties.

Chronologically the medical course intervenes between an undergraduate experience and postgraduate education in either graduate school or internship and residency programs. One of our major aims has been to integrate these three levels in a sufficiently flexible way that students can blend, without redundancy, undergraduate experience, the medical course and postgraduate education to meet their personal objectives.

Any curriculum timetable tends to compartmentalize concepts and knowledge in an arbitrary, rather artificial way. Organization and labelling is necessary but is also hazardous. Some of the divisions which one would like to

dispense with include: normal/abnormal; basic science/clinical; undue emphasis on system blocks; horizontal/vertical curricular subdivisions; and departmental divisions. The dividing lines should be blurred or even unrecognizable. In some cases we have eliminated the dividing lines, for example by planning in a way which renders unnecessary circumscribed courses in subjects such as physiology and pharmacology. In other cases we have remained traditional, e.g. by dividing the clerkship among clinical services. One can foresee that these clinical divisions will disappear in time and that a variety of types of doctors with common interests will group together in a way which will ignore clinical departmental boundaries. The medical school which makes this experiment will be worth watching.

Summary In September 1969 the first class of medical students will be enrolled in a three-year course at McMaster University. An experimental preliminary course will permit some students who lack the requisite university work in behavioural science, cell biology and biochemistry to enrol. Students may enter the first year of medicine after three years of a four-year honours course in biochemistry, cell biology or behavioural science. Such students would receive a B.Sc.(Med.) after the first year in medicine. The curriculum, which is being planned entirely by inter-departmental faculty groups, does not utilize traditional courses in subjects such as physiology or pathology. Emphasis is on the study of major biomedical topics and questions. Students will be encouraged to seek out what information they require to understand the topics and to deal with problems and questions. For each topic, learning aids which have been selected and arranged by the faculty will be available. A faculty-tutorial system will permit small group discussions and learning under personal guidance. In elective periods students will select areas of particular interest to themselves. Students will be members of groups responsible for evaluating and revising the course.

Many persons have contributed to and moulded the development of this curriculum, in particular: Dr. J. R. Evans; original members of the Education Committee, Drs. J. E. Anderson, J. F. Mustard and W. J. Walsh; and our Education Co-ordinator, Mr. J. D. Kraemer.

REFERENCE

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